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Effects of Caffeinated Energy Drink and Alcohol Usage on Perceived Stress and Burnout In Undergraduate Students

Arjun Patel
University of Central Florida

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EFFECTS OF CAFFEINATED ENERGY DRINK AND ALCOHOL USAGE
ON PERCEIVED STRESS AND BURNOUT IN UNDERGRADUATE
STUDENTS

by

ARJUN PATEL

A thesis submitted in partial fulfillment of the requirements
for the Honors in the Major in Health Sciences Pre-Clinical
in the College of Health and Public Affairs
and in the Burnett Honors College
at the University of Central Florida
Orlando, FL

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Thesis Chair: Danielle Webster, Ph.D.

Abstract

Caffeinated energy beverages (CEDs) are a growing supplement being consumed by a large number of young adults aged 18 to 24 years of age. As these CEDs contain nutritional supplements, they are not classified the same way other beverages such as sodas are and they can thus bypass regulation by the Food and Drug Administration. Without regulation by this governing body, it is important to understand how these supplements may be affecting their target population. In this study, students from a large university were recruited in order to determine patterns of CED usage as well as how CED usage may affect perceived stress and burnout. Alcohol usage, another type of beverage commonly consumed in this population, was also assayed in this group in order to determine how perceived stress and burnout are affected. The study was case-control in nature, as regular users of CEDs were compared against students who were not regular consumers. From the data, no major relationships could be identified in regards to perceived stress, burnout, and CED usage. However, extracurricular activity was found to be somewhat predictive of CED usage while alcohol usage was found to be negatively correlated with perceived stress.

Dedication

To my grandmother, who taught me what it means to be hard-working and motivated. It is with the strength, drive, and passion to help others that you have instilled in me that I chase after my dreams of becoming a physician.

To my parents, who are my world and who made it possible for me to have come so far with all their support and love. Without your encouragement I would not have been able to be as successful as I have been.

To my sisters, who are both so incredibly important to me. I am thankful for all the advice and support you both have given me throughout the years.

To my friends, you guys are the reason I haven't lost all my hair yet. Thank you for making sure I had some semblance of a life while I worked through this project.

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Chapter 1: Introduction and Background

History of Caffeinated Energy Drinks

Many students turn to caffeine-containing substances such as coffee and caffeinated energy drinks (CEDs) in order to cope with the daily stresses that arise from their studies, often related to lack of sleep or low energy [1]. Caffeinated energy beverages are a relatively newer source of caffeine, first appearing in 1997 with the introduction of the Red Bull brand of energy drinks. Since their appearance, the energy beverage niche has grown exponentially, with the industry growing to represent \$6.67 billion dollars as of 2013 [2]. A variety of brands from a number of manufacturers have appeared to fill the market, including major beverage manufacturers such as Coca-Cola with their Monster line and PepsiCo with their line of Amp and Starbucks Doubleshot drinks [1, 3].

Composition of Caffeinated Energy Drinks

The hallmark of energy drinks is their purported ability to provide the consumer with sustained energy. This effect is largely due to the high concentration of caffeine often found in the energy drinks, however there are a number of other additives in CEDs that are supposed to have a similar effect [4-6]. For example, in addition to caffeine, CEDs contain additives such as glucuronolactone and taurine along with herbal extracts including ginseng, guarana, and ginkgo biloba [5]. Energy drinks also contain added vitamins and supplements such as vitamin B6 and vitamin B12. The inclusion of these supplements categorizes them as nutritional supplements which thus allows CEDs to bypass regulation of caffeine content and sales by the Food and Drug Administration.

Caffeine is certainly not uncommon to most Americans. According to the Food and Drug Administration, the average American consumes about 132 mg of caffeine per day from sources including coffee, tea, carbonated beverages, and CEDs [7]. CEDs, however, often have the highest caffeine content per serving, some of which can contain more than 200 mg of caffeine in a single serving. Although current research suggests that adults can consume up to 400 mg of caffeine per day safely, many people consume more than one serving of these CEDs and they may be exceeding the limit of safe consumption [4]. Caffeine consumption has been researched in depth, and its effects on mood, alertness, anxiety, cognitive function, and performance amongst other factors are greatly documented in the literature [8, 9]. Use of caffeine has even been shown to significantly increase cortisol levels in the body, a sign of increased stress [10]. As stated previously, CEDs often contain compounds other than caffeine that are marketed as energy- and health-boosting substances. In comparison to the vast database of caffeine information, little is known about the effects that these supposed miracle compounds have on the human body. However, researchers have found that the consumption of these substances, in fact, do not appear to have the purported effects that beverage companies claim in their marketing campaigns [5]. In fact, often times these substances can have negative effects on the body when consumed in high doses [5].

Energy Drink Consumption in Undergraduate Students

With marketing slogans such as “gives you wings” and “unleash the beast,” it is clear that the beverage companies are targeting a certain population. The companies choose these slogans and names such as “Monster” and “Cocaine” intentionally in order

to target younger consumers [11]. Although already 34% of regular CED consumers are in the 18 to 24 year old range, beverage companies still engage in marketing tactics that focus on college-aged students [11, 12]. Red Bull, Monster, and Rockstar all have some form of student brand ambassadors which are positions that students can take up to promote each brand of energy drink across their campus [11, 13].

In addition to directly hiring students for brand promotion, most companies also make heavy use of social media such as Facebook, Twitter, and Instagram in order to keep students connected with their products [14]. In addition to this, brands such as Red Bull and Monster sponsor events that appeal to athletic and creative youngsters, such as a number of sports events including NASCAR and Major League Soccer events in addition to music and art events such as Coachella Valley Music and Arts Festival and South by Southwest Music and Film Festival [15]. From this, it is clear that the risks of regular CED consumption by college students needs to be investigated as this is the primary population in which CEDs are used and to which beverage companies market their products.

As the name suggests, caffeinated energy drinks are characterized by their ability to provide the consumers with a burst of energy. This defining characteristic is sought after by many groups of people including college students who often turn to CEDs to make up for insufficient sleep, to study longer, to help increase their overall energy levels, and to drive long distances. For students, the need to study for lengthy periods often provides the impetus for consumption of high doses of caffeine, often from CEDs.

Caffeinated Energy Beverage and Alcohol Use

Outside of the intended use of CEDs to increase energy, students have also reported CED consumption for recreational use in combination with alcohol during partying and to treat hangovers [1, 11]. The combination use of alcohol mixed with energy drinks can be harmful due to the combination of caffeine, a stimulant, and alcohol, a depressant, and has been associated with a number of risky behaviors including increased alcohol consumption and illicit drug use [16]. Some studies show that this combination can result in decreased perception of alcohol intoxication level which can lead to harmful behaviors such as driving under the influence, although this topic remains under debate [17-19]. In addition to these potential risks, alcohol has been separately linked to stress. One study found that anxiety and stress can increase during drinking binges, contrary to the belief that alcohol ingestion can decrease anxiety [20]. For this reason, alcohol usage in addition to CED usage will be examined, both separately as well as when consumed together recreationally.

Stress-Related Disorders in Undergraduate Students

According to a 2014 report by the American College Health Association, stress was the number one factor that negatively impacted undergraduate student academic performance, closely followed by anxiety and sleep difficulties [21]. Today's undergraduate student is at risk for developing a number of pathological conditions such as depression and anxiety, both of which have been linked to chronic stress [22, 23]. In a younger population, stress can be caused not only by personal relationships, social challenges, and increased academic demands but it is often the result of the development

of poor sleeping habits [24, 25]. Unfortunately for students, the existence of these stressors in their lives cannot only result in the development of chronic stress, but they can in fact propagate already existing stress-related problems.

One of the major outcomes arising from chronic stress is depression. Depression and its effects have been studied greatly in the student population, as the stresses of academics (among other perceived stresses in this population) often provide the foundation for developing depression either during school or post-graduation [26]. Students are thus a higher risk population for developing stress-related mental health issues and must be examined to determine what other influences may contribute to development of stress and potentially subsequent chronic stress. It is thus essential to determine the factors that may exacerbate or propagate stress within this high risk population and address them early.

Burnout in Undergraduate Students

Over time, high stress levels can begin to manifest itself as a number of pathological and mental problems including depression, anxiety, and as this research study hopes to understand, burnout [27, 28]. Burnout is a state characterized by emotional exhaustion and cynicism towards one's work that results from chronic stress and emotional drainage [29]. Although students were not traditionally thought of as experiencing burnout, the change in expectations for students recently has led to increased stress in student lives. With these changes, burnout has been more prevalent in college students [27, 30-33]. Burnout has become a major problem in the workforce as many professionals move directly from schooling into jobs and careers. The experience

of prolonged burnout syndrome has also been strongly linked with the development of depression, thus information about the progression of burnout in students using CEDs may be beneficial to understand the safety of CED consumption [34]. There is great concern for understanding sources of stress and burnout amongst students, as many of these students plan to enter the workforce or pursue graduate study after they have completed their undergraduate coursework. Burnout in school may potentially translate into occupational burnout as students with high stress levels move directly from schooling into jobs or further training [33]. Additionally, the relationship between burnout and depression warrants further understanding of the pathogenesis of burnout and chronic stress-related disorders in college students. Stress and academic burnout are strong indicators of academic performance in students, and as such will be examined in this context as well in order to elucidate the effects of energy drink use in the academic setting [35].

Chapter 2: Methodology

Study Design and Data Collection

The study conducted was a case-control study in which students who regularly consumed CEDs, both with and without alcohol, within the previous thirty days (cases) are compared with students who did not regularly consume CEDs (controls) in the same time period. The relationships that are being investigated will be correlational in nature, and thus confounding factors must be considered throughout the study. This study not only seeks to understand the role of CED and/or alcohol consumption on perceived stress and burnout in undergraduate students, but it also seeks to understand the patterns of CED and/or alcohol consumption in this population. Undergraduate university students were the target population, as this study seeks to understand the potential role or association of CED consumption in the progression of stress and burnout in undergraduates. This study also hopes to gain insight into the attitudes of participants towards CED usage and how their usage or non-usage is influenced by their experiences. There are dedicated items in the survey instrument to address some of these aspects. Undergraduate participants were obtained by convenience sample through the use of an online survey management and delivery system. The survey was distributed primarily in person and via social media. Students who were willing to participate were asked to complete a 33-item questionnaire which collected demographic information as well as information regarding student perceived stress, burnout, CED consumption, and alcohol usage.

Students were primarily grouped according to their level of CED and/or alcohol consumption. They will then be categorized by demographic information including their area and year of study, ethnic background, and gender to be analyzed. Data collection will occur over a period of six weeks. Data collected will be processed quantitatively based on the corresponding scoring protocol for each scale used. Once the survey responses were translated into numeric data, statistical analyses was completed to determine relationships amongst the information obtained from the scales. The major relationships investigated via statistical analysis included the correlation between CED usage and perceived stress/burnout and the correlation between CED usage in combination with alcohol usage and perceived stress/burnout. Further analysis was completed to determine these relationships in the context of the collected demographic information.

Study Hypotheses

H₁ (experimental): There will be a statistically significant relationship between CED usage and PSS scores and CED usage and MBI-SS scores.

H₀ (null): There will be no relationship between CED usage and PSS scores or CED usage and MBI-SS scores.

Alternative Hypotheses

H_{a1} (alternative hypothesis #1): Regular CED users will have higher odds of having high PSS and MBI-SS scores.

H_{a2} (alternative hypothesis #2): There will be a statistically significant association between alcohol usage and PSS scores and alcohol usage and MBI-SS scores.

H_{a3} (alternative hypothesis #3): Certain students, such as those with high extracurricular activity levels, will be more likely to use CEDs and/or alcohol regularly.

Instrumentation and Measurement of Perceived Stress and Student Burnout

Perceived stress is a measure of the amount by which a person perceives certain situations in their lives as stressful [36]. Perceived stress is often used as a psychometric measure that allows for the connection of stress levels to pathology. Stress and its effects on the body are often due to one's perception of certain situations, and as such one's perception of stress can manifest itself as physiological problems. Situations that are considered stressful can only be considered stressful relative to one's perception, as many physiological effects of stress will be dependent on one's self-perception of stress [37]. In this study, perceived stress was measured using an established scale known as the Perceived Stress Scale (PSS). The 10-question version of the PSS was used as it has been shown to be effective and psychometrically sound in the measurement of relative stress experienced by college students [38]. Each item on the PSS was scored on a 5-point Likert scale (0=never, 1=almost never, 2=sometimes, 3=fairly often, 4=very often).

Burnout is a condition resulting from prolonged periods of feeling overworked, highly stressed, and emotionally exhausted and it has traditionally been a condition attributed to people who work in the service industry [27]. Recently, however, burnout has become a major issue for all persons that experience high-stress situations and these feelings of psychological distress [27, 39]. The Maslach Burnout Inventory-Student Survey (MBI-SS) is a well-established variant of the original Maslach Burnout Inventory

which has been widely used to measure burnout in individuals since it was published in 1981 [27, 40, 41]. The modified MBI-SS has since been used to determine the extent of burnout in student samples, and was therefore used exclusively here to quantify burnout in undergraduate students. For this study, burnout will be characterized in students through three categories described by the MBI-SS: exhaustion, cynicism, and professional efficacy [27]. Exhaustion is defined as feelings of fatigue towards one's work, while cynicism describes the feeling of indifference or a distant attitude towards one's work. Professional efficacy is a measure of the social and nonsocial facets of occupational accomplishments and will be scored opposite to exhaustion and fatigue. Professional efficacy is scored opposite to exhaustion and fatigue because high scores in exhaustion and fatigue are indicative of burnout whereas burnout is indicated when professional efficacy scores are low [27]. Due to this, burnout will be measured by reverse scoring the items in the questionnaire that refer to professional efficacy [27]. Each item on the MBI-SS was scored on a 7-point Likert scale (0=never, 1, 2, 3=sometimes, 4, 5, 6=always)

Data Analysis

The Statistical Package for Social Sciences was used to compile and analyze the data obtained from the survey instruments during the data collection phase. Information regarding CED and alcohol usage was converted to numerical data in order to correlate the level of CED/alcohol usage with the other variables being examined. The PSS score was calculated by using the standard protocol for the 10-item PSS by summation of all responses from the survey [36]. Higher PSS scores indicated higher levels of perceived stress as self-reported by the subjects. MBI-SS scores were calculated according to the

protocol set forth. First, all items regarding professional efficacy were reverse-scored and subsequently added to the scores of all other items in the MBI-SS. Higher MBI-SS scores represented higher levels of burnout [27].

Chapter 3: Results

Sample Demographics

A total of 234 undergraduate students completed the survey instrument through an online survey distribution and management system. The study sample participants were all undergraduate students, ranging from 18 to 45 years of age, with 60.7% of students aged 18 to 21. The majority of participants were females, representing 70.5%, while males represented 29.5% of the sample. Roughly half of the study participants represented the Health Sciences Pre-Clinical and Biomedical Sciences majors, representing a combined majority of 54.7% ($n = 128$). This representation is likely a result of selection bias as discussed in the methodological limitations chapter (Chapter 5). Psychology students represented 6% of students, and other majors such as biology, nursing, and engineering represented the remaining sample participants. 86.8% ($n = 203$) of the sample represented upperclassmen including juniors, seniors, super-seniors, and those who have been working on a bachelor's degree for five or more years. Additionally, the majority of participants were white (59.8%, $n = 140$) followed by Hispanic and Latinos, African-Americans, and Asians and Pacific Islanders.

Sample Participants and Caffeinated Energy Drink, Alcohol, and Combined Usage

Regular consumers of the beverages investigated were defined as users who consumed one or more beverage per week on average over the past 30 days. Of all student participants, 23.5% ($n = 55$) were considered regular CED users. Caffeinated energy drinks were defined as any beverages marketed as energy drinks or energy-boosting that contained caffeine as one of the ingredients. Alcoholic drinks were defined

as any beverages that contained alcohol. Combined energy drink and alcohol usage was defined as either a combination beverage mixing CEDs and alcohol or the consumption of either a CED or alcohol beverage while under the influence of the other. Of all student participants, 60.7% ($n = 142$) were considered regular alcohol consumers while 3.8% ($n = 9$) were considered regular combination CED and alcohol consumers. Participants were asked how many CEDs alone, how many alcohol drinks, and how many combined CEDs and alcohol drinks they had consumed per week on average in the past 30 days in order to assess usage. Consumption was categorized into three categories based on the number of beverages consumed per week on average: low usage (1-2 beverages per week), medium usage (3-4 beverages per week), and high usage (5 or more beverages per week). The consumption of CEDs is summarized below in **table 1**.

Table 1. CED, Alcohol, and Combined Usage in Sample

	<i>Low Usage</i> <i>(1-2 beverages per week)</i>	<i>Medium Usage</i> <i>(3-4 beverages per week)</i>	<i>High Usage</i> <i>(5 or more beverages per week)</i>	<i>Non-Users</i> <i>(did not consume beverages regularly)</i>
Caffeinated Energy Beverages Users	37 (15.8%)	14 (6.0%)	4 (1.7%)	179 (76.5%)
Alcoholic Beverages Users	92 (39.3%)	30 (12.8%)	20 (8.5%)	92 (39.3%)
Combined Caffeinated Energy Beverages and Alcoholic Beverages	8 (3.4%)	1 (0.4%)	0 (0%)	225 (96.2%)

Student Attitudes Towards Energy Drink Consumption

In addition to studying the variables of perceived stress and burnout along with CED usage in this sample, the researchers also hoped to understand attitudes towards

CED usage and what influenced students to use CEDs regularly. Dedicated survey items were used to assess some of these questions, such as whether or not the availability of CEDs on campus affects student usage or why a particular student might use the CEDs. Questions regarding reasons for CED usage were limited by the survey system to students who answered previous questions that classified them as regular CED consumers. This information is summarized and detailed in **tables 2** and **3**. Information regarding the level of extracurricular activities for each student participant was also collected and compared to the number and percentage of students that consumed CEDs regularly, shown in **table 4**.

Table 2. Student Attitudes Towards CED Usage

	<i>n</i>	%
Number of students who reported initiation of CED usage during final exams	34 (179 non-users)	19.0%
Number of students who currently use CEDs regularly and reported an increase in CED usage during final exams	36 (55 regular CED users)	65.4%
Number of students who currently use CEDs regularly and would decrease or cease CED consumption if they were no longer available on campus	16 (55 regular CED users)	29.1%

Table 3. Reasons for CED Consumption in Regular Consumers

	<i>n</i>	% (of regular CED consumers)
To stay awake to study longer	41	74.5%
To stay awake while at work	32	58.2%
To make up for lost sleep	26	47.3%
To help boost exam performance	18	32.7%
To party longer	6	10.9%

Table 4. Extracurricular Level and CED Usage

<i>Extracurricular Level</i>	<i># of Regular CED Consumers</i>
Low (1-10 hours per week) <i>n</i> = 53	8 (15.1%)
Medium (11-20 hours per week) <i>n</i> = 71	10 (14.1%)
High (more than 20 hours per week) <i>n</i> = 98	33 (33.7%)

Perceived Stress and Burnout in Student Participants

Perceived stress scores and MBI-SS burnout scores were calculated according to the published protocols [27, 36]. Averages and other descriptive statistics for each score were calculated in regular CED users and non-users to compare. High and low levels of perceived stress and burnout were defined by any PSS or MBI-SS score that was above and below, respectively, the average of the PSS and MBI-SS scores of all study participants. **Table 5** describes this information in male versus female participants. The average scores along with standard deviations are described in **table 6** organized by grade level for all study participants. **Table 7** shows the number of participants with high PSS and MBI-SS scores in groups of students who regularly used CEDs only and not alcohol and groups of students who regularly used alcohol only and not CEDs.

Table 5. CED Usage, Perceived Stress, and Burnout in Male vs. Female Students

	<i>Males (n = 69)</i>	<i>Females (n = 165)</i>
Number of Regular CED Users	22 (31.9%)	33 (20.0%)
Average PSS Score	20.8 ± 2.9	22.1 ± 3.9
High PSS Scores* (n, %)	28 (40.6%)	86 (52.1%)
Average MBI-SS Score	24.4 ± 11.3	31.4 ± 13.1
High MBI-SS Scores** (n, %)	23 (33.3%)	98 (59.4%)

* High PSS scores = scores ≥ 21.7 (average PSS for entire sample)

** High MBI-SS scores = scores ≥ 29.3 (average MBI-SS for entire sample)

Table 6. Perceived Stress and Student Burnout Data by Grade Level

	<i>Average PSS</i>	<i>High PSS Scores* (n, %)</i>	<i>Average MBI-SS</i>	<i>High MBI-SS Scores** (n, %)</i>	<i>Regular CED Users (n, %)</i>
Freshmen <i>n</i> = 12	23.9 ± 3.8	7 (58.3%)	28.0 ± 10.5	6 (50%)	1 (8.3%)
Sophomore <i>n</i> = 19	21.4 ± 3.8	10 (52.6%)	34.3 ± 7.7	13 (68.4%)	5 (26.3%)
Junior <i>n</i> = 73	20.9 ± 3.6	33 (45.2%)	28.4 ± 13.0	33 (45.2%)	16 (21.9%)
Senior <i>n</i> = 94	21.9 ± 3.7	45 (47.9%)	28.4 ± 13.6	46 (48.9%)	21 (22.3%)
5 or More Years <i>n</i> = 36	22.1 ± 3.2	19 (52.8%)	31.6 ± 13.9	23 (63.9%)	12 (33.3%)
All Participants <i>n</i> = 234	21.7 ± 3.6	114 (48.7%)	29.3 ± 13.0	121 (51.7%)	55 (23.5%)

* High PSS scores = scores ≥ 21.7 (average PSS for entire sample)

** High MBI-SS scores = scores ≥ 29.3 (average MBI-SS for entire sample)

Table 7. Participants Using Only CEDs or Alcohol with High PSS or MBI-SS Scores

	<i>High PSS*</i>	<i>High MBI-SS**</i>
CEDs Only <i>n</i> = 15	6 (40.0%)	8 (53.3%)
Alcohol Only <i>n</i> = 102	52 (51.0%)	46 (45.1%)

* High PSS scores = scores ≥ 21.7 (average PSS for entire sample)

** High MBI-SS scores = scores ≥ 29.3 (average MBI-SS for entire sample)

Chapter 4: Discussion

A number of research studies have been conducted that examine caffeinated energy drink usage in college students. While many of these studies examined patterns of usage and effects of combination CED and alcohol usage on things such as risk-taking and negative behaviors, none of the studies examined the role of CED consumption in the pathogenesis of stress and the progression of student burnout. Through this study, the researchers hoped to examine a number of proposed questions. First, we were interested in whether or not a statistically sound correlation existed between CED usage and either perceived stress or student burnout. We were also interested in understanding whether or not students with high CED consumption were at higher odds for having above-average PSS or MBI-SS scores. In the context of alcohol usage, a common substance used in this population and often in combination with CED usage, we were interested in understanding how students using alcohol compared to students using CEDs and how perceived stress and burnout appears in these separate groups. Finally, we were interested in understanding what demographic characteristics might be predictive of CED usage and if that predictive relationship was observed for high PSS or high MBI-SS scores.

Patterns of CED Usage

As stated previously, roughly 1 in 4 students was a regular CED user ($n = 55$, 23.5%). Of these regular CED users, the majority were low users ($n = 37$, 15.8%), having consumed only one to two energy beverages per week on average, indicating few users who relied on CEDs heavily. As expected, regular alcohol usage ($n = 142$, 60.7%) is more

widespread than regular CED usage, however there were less regular combination CED/alcohol users than expected ($n = 9$, 3.8%). As expected, a larger percentage of males consumed CEDs regularly than females (see **table 5**).

Students were organized into groups based on their extracurricular activity levels (low, medium, and high) to compared CED usage amongst these groups (see **table 4**). Extracurricular activities were defined as activities outside of coursework such as volunteering, employment, sports, research etc. Pearson correlation coefficients were used to examine bivariate correlations amongst the variables. A statistically significant, albeit weak, correlation was discovered between extracurricular activity level and CED usage ($r = 0.148$, $p < 0.05$). Though this correlation is somewhat weak, the trend is positive, indicating that students with higher extracurricular activity levels would need to use CEDs more often to get through their commitments. This finding is rational, as students with higher workloads may require the use of CEDs. Therefore, extracurricular workload may be predictive of CED usage.

Students were also asked about the reasons for their CED usage. The data for this is shown in **table 3**. As expected in this student population, the majority of students who consumed CEDs reported using CEDs regularly “to stay awake to study longer,” ($n = 41$, 74.5%) followed by 58.2% ($n = 32$) of students reporting they used CEDs regularly “to stay awake while at work.” With 74.5% of CED users using energy drinks in order to study longer, it is clear that CED usage in this sample is largely driven by academic workloads.

Attitudes Towards CED Usage

Part of this study attempted to understand student attitudes towards using caffeinated energy beverages. A number of survey items were dedicated to this goal. **Table 2** describes some information regarding these attitudes. Interestingly, 19% ($n = 34$) of students who did not normally consume energy beverages reported CED consumption during final exams. This is easily rationalized as students needing higher levels of caffeine in order to study for longer periods of time during their exams. Future research may consider these students and how their perceived stress levels are modulated during times necessitating CED consumption. Additionally, 65.4% ($n = 36$) of students who were considered regular CED users stated that their CED consumption increased during final exams. When compared to the 19% of students who initiated CED consumption only during final exams, it appears that students who are already CED users are more likely to consume more CEDs during exam time. This is noteworthy, as students who are already regular CED users may be prone to adverse effects that are associated with increased consumption and possible abuse.

CED Usage, Perceived Stress, and Burnout

One of the major questions that this study hoped to answer was whether or not a relationship existed between CED usage and perceived stress or student burnout. After bivariate analysis and calculation of Pearson correlation coefficients, it appears that there are no statistically significant relationships amongst these variables. We were also interested in whether or not there was any association, so odds ratios were calculated for the exposure (CED usage) and the outcomes (above-average values for both PSS and

MBI-SS scores). There appeared to be no statistically significant association between CED usage and either high PSS scores or high MBI-SS scores, as the 95% confidence intervals crossed the null value ($OR = 1$). As described in **table 5**, males used CEDs regularly more than females. Interestingly, the average PSS and MBI-SS scores for males were lower than those for females. In addition to this, males had lower percentages of students with high PSS and MBI-SS scores (above the averages for the whole study sample). This is interesting, however it is important to consider the survey instrument in this case. All items were self-reported, thus differences in perceptions of stress and burnout items by males versus females would certainly affect how this data is interpreted.

Overall, the data supports the null hypothesis, in that there appears to be no association between CED usage and PSS and MBI-SS scores. The researchers also decided to analyze potential relationships between alcohol only users and combination CED and alcohol users, to see if there were significant relationships with stress and burnout. Interestingly, we found a statistically significant negative correlation between alcohol only usage (students who consumed alcohol regularly but not CEDs) and perceived stress scores. The Pearson correlation coefficient of -0.205 ($p < 0.05$) indicates a negative correlation, such that students with increasing amounts of regular alcohol use showed comparatively lower values for their PSS scores. This relationship was not anticipated by researchers, as research surrounding alcohol and perceived stress has been unable to determine strong relationships, although binge drinkers have been shown to possibly have higher levels of stress [20, 42, 43]. No appreciable information could be analyzed from students who were regular combination users of CEDs mixed with alcohol.

There were limitations with this group that are discussed in the methodological limitations chapter, particularly the smaller number of students in this group.

Chapter 5: Methodological Limitations

The results of this study should be considered in the context of a number of limitations. Any study of this type will suffer from bias, specifically in this case: recall and selection bias. Additionally, sample size should always be considered in addition to sampling methods.

For this study, the sample size of 234 may not have been broad enough to obtain useful data as only 55 students were considered exposed while 179 were not exposed (controls). Obtaining statistically relevant data in an exposure group of 55 can be difficult, and may not represent the true relationships should they exist. Further classification of subgroups in this study yielded smaller and smaller groups. There were only 9 students who consumed combination CEDs mixed with alcohol, preventing true analysis. Comparing the unequal number of students in each group was very difficult due to the diverse sample.

Sampling methods contributed to some of the selection bias. For example, a convenience sample was used to obtain student participants at UCF. The researchers had backgrounds and connections with science-related groups and courses, so a large percentage of student participants came from science majors. Additionally, the ages of study participants is something to consider. Many students were recruited for this study from the researcher's classes. These classes have primarily upperclassmen, thus biasing the sample and skewing the average grade level of the students. This can have profound effects on any study in the student population. In retrospect, other sampling methods

should have been considered to decrease selection bias and ensure diversity of the sample.

An obvious and common bias in case-control studies such as this is recall bias. Students were asked about their consumption and emotions over the previous thirty day period. Many people have difficulty recalling this information over such a long time period. Since a survey instrument was used, the self-reporting of the survey items may have been inaccurate due to this recall bias, further contributing to potential sources of error or variation. Future work may need re-evaluation of survey items and possible changes to the time periods over which information is obtained. A previous study of recall bias in the seven-day recall measurement of alcohol showed that recall bias is a threat at even seven days prior, so it would be necessary to adjust the time frame to shorter than thirty days should the study be repeated or adjusted [44].

Chapter 6: Conclusion

With CED usage increasing so rapidly and so many new and different products move to fill the market, it is important that their potential effects on target populations are evaluated and understood. Although in this particular study no statistically significant relationships were found between CED usage and perceived stress or burnout, there are still a number of issues that may arise with energy drink abuse.

Overall, only 23.5% of students were regular CED users. This is a smaller percentage of students than the researchers expected who would be using CEDs regularly, however our definition of regular CED usage was stricter than definitions from other studies. Even more surprising however was the fact that only 3.8% of students surveyed were regular combination energy drink and alcohol users. The small number of students in each of these subgroups was certainly considered as a limitation in this study. After attempting to understand CED usage patterns amongst the sample, we were able to see a relationship between extracurricular activity and CED usage. As expected, the two variables had positive trends and thus extracurricular activity may be considered a predictor of CED usage. This data is consistent with the reported reasons for CED usage, as students who used CEDs regularly more often reported that their consumption was mainly in order for them to stay awake longer to study. When asked about how the availability of CEDs on campus affected their usage, 29.1% of regular users said they would either decrease their usage or cease CED consumption altogether. This may be important to consider if CED abuse becomes an issue on college campuses.

Although no appreciable relationships were observed for CED usage and PSS/MBI-SS scores, there were still some interesting trends interpreted from the data. Alcohol usage appeared to be negatively correlated with PSS, indicating that alcohol usage may help students cope with their stresses such that the students' perceptions of stress are lowered. Beyond this, future work may be expanded to study the daily changes in stress and burnout perceptions in students who used and did not use CEDs. This may help decrease recall bias, and allow for more accurate data collection and validation. Students may also be recruited for a prospective study in which CED usage is controlled in order to further elucidate changes in student perceptions of stress with and without CEDs.

Appendix A

IRB Approval Letter



University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1
FWA00000351, IRB00001138**

To: **Danielle Melissa Webster and Co-PI: Arjun Patel**

Date: **December 10, 2014**

Dear Researcher:

On 12/10/2014, the IRB approved the following activity as human participant research that is exempt from regulation:

Type of Review: Exempt Determination
Project Title: Effects of Regular Consumption of Caffeinated Energy Beverages
on Perceived Stress and Burnout in Undergraduate Students
Investigator: Danielle Melissa Webster
IRB Number: SBE-14-10772
Funding Agency:
Grant Title:
Research ID: N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the [Investigator Manual](#).

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

A handwritten signature in black ink, appearing to read "Patria Davis", written over a horizontal line.

Signature applied by Patria Davis on 12/10/2014 02:35:48 PM EST

IRB Coordinator

Appendix B

Survey Instrument

Energy Drink Consumption in Undergraduate Students

Explanation of Research and Participant Consent

ID 4

I agree to the above terms and would like to voluntarily participate in this study. *

- ☐ I agree.
- ☐ I do not agree and would like to exit this survey.

Demographic and Education Information

Page description:

ID 10

1. What is your age? *

- ☐ 18-21 years old
- ☐ 22-25 years old
- ☐ Other (required) *

ID 11

2. What is your gender? *

- ☐ Male
- ☐ Female

10 12

3. What is your ethnicity? *

- ☐ White
- ☐ Hispanic or Latino
- ☐ Black or African-American
- ☐ Native American or American Indian
- ☐ Asian or Pacific Islander
- ☐ Other (required) *

10 15

4. What year in school are you? *

- ☐ Freshman
- ☐ Sophomore
- ☐ Junior
- ☐ Senior
- ☐ Super-Senior
- ☐ 5+ Years

10 16

5. What is your major? *

- ☐ Biomedical Sciences (Molecular and Microbiology)
- ☐ Health Sciences - Pre-Clinical
- ☐ Psychology
- ☐ Nursing
- ☐ Biology
- ☐ General Business
- ☐ Elementary Education
- ☐ Accounting
- ☐ Interdisciplinary Studies
- ☐ Hospitality Management
- ☐ Finance
- ☐ Marketing
- ☐ Mechanical Engineering
- ☐ Criminal Justice
- ☐ Political Science
- ☐ Other (required) *

ID 57

6. How many hours per week on average do you spend on extracurricular activities? (Note: this includes any time spent on paid jobs, volunteering, internships, sports, research, etc.) *

- ☐ 1-10 hours per week on average
- ☐ 11-20 hours per week on average
- ☐ More than 20 hours per week on average
- ☐ I do not participate in any extracurricular activities.

Energy Drink Consumption

Page description:

ID 18

7. In the past 30 days, how many energy drinks (e.g. Monster, Full Throttle, Red Bull, 5-Hour Energy, Amp, Rockstar etc.) did you consume on average per week? *

- ☐ 1-2 energy drinks per week
- ☐ 3-4 energy drinks per week
- ☐ 5 or more energy drinks per week
- ☐ I have not consumed any energy drinks in the past 30 days.

ID 19

8. In the past 30 days, how many alcoholic beverages did you consume on average per week?

*

- ☐ 1-2 alcoholic beverages per week
- ☐ 3-4 alcoholic beverages per week
- ☐ 5 or more alcoholic beverages per week
- ☐ I have not consumed any alcoholic beverages in the past 30 days.

ID 21

9. Did the average number of energy drinks you consumed increase during your final exams? *

- ☐ Yes, it increased to 1-2 energy drinks per week during final exams
- ☐ Yes, it increased to 3-4 energy drinks per week
- ☐ Yes, it increased to 5 or more energy drinks per week
- ☐ No, the average number of energy drinks I consumed did not increase during my final exams.

ID 55

10. How would your current energy drinks usage change if energy drinks were not available for purchase on campus? (Note: this includes vending machines, convenience stores, and other areas where energy beverages are for sale on campus) *

- ☐ I would consume less energy drinks than I currently do if they were not available for sale on campus.
- ☐ I would cease consumption of energy drinks if they were not available for sale on campus.
- ☐ The lack of availability of energy drinks on campus would not affect my energy drink consumption.

Energy Drink Consumers

Page description:

ID 20

11. In the past 30 days, how many alcoholic beverages mixed with energy drinks did you consume on average per week? (Note: this includes any energy drinks consumed while under the influence of alcohol) *

- ☐ 1-2 alcoholic beverages mixed with energy drinks per week
- ☐ 3-4 alcoholic beverages mixed with energy drinks per week
- ☐ 5 or more alcoholic beverages mixed with energy drinks per week
- ☐ I did not consume any alcoholic beverages mixed with energy drinks in the past 30 days.

ID 53

12. Which of the following is/are reason(s) that you have used energy drinks in the past 30 days? (Note: you may select more than one if appropriate) *

- ☐ To stay awake in order to study longer
- ☐ To help make up for lost sleep
- ☐ To stay awake at work
- ☐ To help boost performance on exams
- ☐ To party longer

Perceived Stress Scale

Page description:

ID 24

13. Please complete the following questions by choosing the appropriate frequency choice regarding your experiences and emotions during that past 30 days to the best of your ability. *

	0 (never)	1	2 (sometimes)	3	4 (very often)
In the last month, how often have you been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt nervous and "stressed"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt confident about your ability to handle your personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you found that you could not cope with all the things that you had to do?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you been able to control irritations in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt that you were on top of things?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you been angered because of things that were outside of your control?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Student Burnout Inventory

Page description:

ID 37

14. Please complete the following questions by choosing the appropriate frequency choice regarding your experiences and emotions during that past 30 days to the best of your ability. *

	0 (never)	1	2	3	4	5	6 (always)
I feel emotionally drained by my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel used up at the end of a day at university.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel tired when I get up in the morning and I have to face another day at the university.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Studying or attending class is really a strain for me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel burned out from my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have become less interested in my studies since my enrollment at the university.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have become less enthusiastic about my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have become more cynical about the potential usefulness of my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I doubt the significance of my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can effectively solve the problems that arise in my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I believe that I make an effective contribution to the classes that I attend.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In my opinion, I am a good student.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I feel stimulated when I achieve my goals.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I have learned many interesting things during the course of my studies.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
During class I feel confident that I am effective in getting things done.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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